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Fort Oglethorpe. Up to April 27, 1918, when new methods were put into use, approximately 140,000 soldiers had been examined. On July 1, 1918, 600,000 had been examined. Of this number, slightly more than 0.25% had been recommended by psychological examiners to psychiatrists for discharge because of mental deficiency, and about 0.5% had been recommended for assignment to service organizations for development battalions because of mental inferiority.

Psychological examinations which were originally conducted in wards of Base Hospitals, are now made in a psychology building located usually in the Depot Brigade. In this building, drafted men are examined promptly on reporting to camp. Their intelligence ratings are immediately transmitted to the Personnel Officer of the camp. All cases of mental deficiency, or those for which psychiatric examination is indicated as desirable, are referred to the psychiatrist.

The aim of the Division of Psychology, Surgeon General's Office, is to develop a psychological center in each military training camp to which all psychological problems of military assignment, training, discipline, morale, and intelligence may be referred by officers of the line or staff. Such a center exists in twenty-five camps, and the service is being extended as rapidly as available personnel permits.

(Publication approved by the Board of Publications, Office of the Surgeon General.)

THERMO-ELECTRIC ACTION WITH THERMAL EFFUSION IN METALS: A CORRECTION

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The last paragraph of my paper in these Proceedings for April, 1918, dealt incorrecly with the effect of 'hypothesis (B)' the hypothesis that free electrons in the interatomic spaces of an unequally heated metal bar have a tendency like that which in ordinary gases produces the phenomena of thermal effusion.

In a common gas the condition of equilibrium maintained by thermal effusion is not p constant but $p \propto T^{\frac{1}{2}}$, where T is the absolute temperature. In dealing with the free electrons, for which the R of the equation $pv = NRT$ may not be a constant, we have as the condition which thermal effusion tends to create

$$p \propto (RT)^{\frac{1}{2}} \tag{1}$$

whence

$$dp = \frac{p}{2}\left(\frac{dR}{R} + \frac{dT}{T}\right). \tag{2}$$

If we take one gram of electrons, each of mass m, we have

$$pv = \frac{1}{m} RT, \tag{3}$$

and by substitution in (2) we get

$$dp, \text{ or } (dp)_s = \frac{1}{2v} \cdot d\ (pv). \tag{4}$$

This is the difference of pressure which the free electrons within a metal could bear without drift and without the help of electrical force. It may be called the *static difference of pressure*, $(dp)_s$.

If, now, there exists within a metal a free-electron pressure $dp > (dp)_s$, the excess

$$dp - (dp)_s, \text{ or } dp - \frac{1}{2v} \cdot d\ (pv), \tag{5}$$

will be the true mechanical driving force operating to maintain a drift of the electrons. Hence the introduction of 'hypothesis (B)' requires the substitution of $dp - (1 \div 2v)\ d(pv)$ for dp in the second member of equation (4), of my paper referred to above, and makes the whole equation read

$$(P_c - P_h) + \int^c \frac{k_f}{k} \cdot dP_f + \int_h^c \frac{k_a}{k} \cdot dP_a = \frac{1}{Ge} \int_c^h \frac{k_f}{k} \left(vdp - \tfrac{1}{2} d\ (pv) \right), \tag{6}$$

where k has the same meaning as the $(k_a + k_f)$ used in the original equation.

This is the expression for the 'virtual e.m.f.' resident in a detached metal bar having one end at T_h and the other at T_c. In my previous discussion of this matter, not written out in my April paper, I had proceeded as if the factor $(k_f \div k)$ could be put with the (pv) so as to give $d\,[(k_f \div k)(pv)]$. This error led to my giving figure 4 of that paper as the graphical representation, on the P-V plane, of the virtual e.m.f. in question.

The second member of equation (6) can be put into the form

$$\frac{1}{Ge} \int_c^h \frac{k_f}{k} \left(\tfrac{1}{2}\, vdp - \tfrac{1}{2}\, pdv \right),$$

and the graphical representation of this expression is given in figure 1. Here $A\ D$ is the pv line for one gram of free electrons in the metal; $A'\ D'$ is obtained from $A\ D$ by applying the proper value of the factor $(k_f \div k)$ to each value of v; and $A'\ D'$ is obtained for $A\ D$ by applying the proper value of the factor $(k_f \div k)$ to each value of p. $A''\ D''$ is obtained from $A'\ D'$ by taking one-half of each value of v, so that the area $E\ A''\ D''\ G$ represents the part $\frac{1}{2} \int_c^h \frac{k_f}{k} \cdot vdp$ of (7). $A_1''\ D_1''$ is obtained from $A_1'\ D_1'$ by taking one-half of each value of p, so that $A_1''\ D_1''\ d\ a$ represents the part $-\frac{1}{2} \int_c^h \frac{k_f}{k} \cdot pdv$ of (7).

The sum of these two areas, multiplied by (1 ÷ *Ge*), represents the virtual e.m.f. in question.

If the line $A\ D$ were of constant pv, as it might be if we were dealing with an isothermal 'alloy bridge,' the two shaded areas would be equal and their sum would equal $E\,A'\,D'\,G$. That is, there would be no tendency to 'thermal effusion' in such a case, and the virtual e.m.f. would reduce to

$$\frac{1}{Ge}\int_c^h \frac{k_b}{k}\cdot v\,dp,$$

the value it has under hypothesis (A).

The total effective e.m.f. for a closed circuit made up of two different metals and two isothermal alloy bridges is represented by (1 ÷ *Ge*) times the sum of two areas like $A''\,B''\,C''\,D''$ and $A''_1\,B''_1\,C''_1\,D''_1$ in figure 2, where the path $A\ B\ C\ D$ represents the pv changes of one gm. of *free* electrons throughout the circuit.

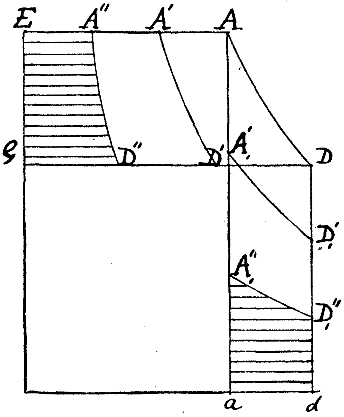

FIG. 1

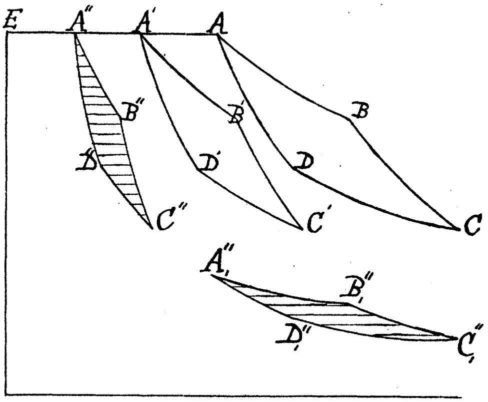

FIG. 2

The total effective e.m.f. of the circuit is not, as I have previously believed it to be, necessarily the same under hypothesis (B) as under hypothesis (A). For the latter case it is represented in figure 2 by (1 ÷ *Ge*) times the area $A'\,B'\,C'\,D'$, the boundary of which corresponds to the changes of pressure and volume undergone by 1 gram of electrons, in part free electrons and in part associated electrons, in going around the circuit as part of a current.

I had overlooked the interesting fact that, when we have to do with thermal effusion, which overrides the tendency to equality of pressure throughout a gaseous body, we can no longer calculate the work done by or on a body of gas by means of a mere diagram of its pressure-volume changes. Thus, in a vertical cylinder containing a column of air, kept warmer at the top than at the bottom, a porous partition extending partly across the cylinder would constantly transmit air upward through its interstices, to be returned downward past the edge of the partition, and work could thus be done by means of air acting in a pv cycle of no area.